

OPERATING SUMMARY

THUNDER BAY

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DEPUTY MINISTER
E. Biggs

ASSISTANT DEPUTY MINISTER
REGIONAL OPERATIONS
J. Barr

REGIONAL OPERATIONS DIVISION

DIRECTOR, NORTHWESTERN REGION
L. Pitura

MANAGER, UTILITY OPERATIONS
M. Reid

THUNDER BAY
WATER POLLUTION CONTROL PLANTS

operated for

THE CITY OF THUNDER BAY

by the

MINISTRY OF THE ENVIRONMENT

1973 ANNUAL OPERATING SUMMARY

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'73 Review

GENERAL

Two primary sewage treatment plants located in the north and south wards service the majority of the people residing in Thunder Bay. The total staff for both plants, and the Brunswick Avenue pumping station, was reduced to twelve from thirteen. This was carried out on an experimental basis by eliminating the afternoon shift.

EXPENDITURES

The total operating cost was \$196,855. This represents an average cost of \$44 per million gallons treated and sixteen cents per pound of BOD removed.

PLANT FLOWS AND CHLORINATION

A total of 2,163 million gallons was treated at the south ward plant with an average daily flow of 5.92 million gallons. The average daily flow represents 98.7 per cent of the nominal design capacity which is an increase of 14.4 per cent over 1972. Chlorination was carried out on a regular basis at an average dosage of 3.7 mg/l. A total of 79,900 pounds of chlorine was used.

The north ward plant received a total of 2,348 million gallons. The average daily flow was 6.43 million gallons, which represents 160.8 per cent of the nominal design capacity. This is a slight increase over 1972. Chlorination was carried out from March to October at an average dosage of 4.1 mg/l. A total of 53,200 pounds of chlorine was used during this period.

By-passing was carried out at the north ward plant when the flow exceeded 8.0 MGD. The by-passed flow was chlorinated.

PLANT EFFICIENCY

The influent BOD concentration at the south ward plant averaged 120 mg/l which was reduced 20 per cent to an average effluent BOD concentration of 96 mg/l. The average influent suspended solids concentration of 130 mg/l was reduced to an average effluent concentration of 79 mg/l, a reduction of 40 per cent. A total of 7,098 cubic feet of grit was removed.

The north ward plant average influent BOD concentration was 130 mg/l. An average reduction of 23 per cent was realized with an average effluent BOD concentration of 100 mg/l. The average raw suspended solids concentration was 140 mg/l which was reduced to 76 mg/l, a reduction of 46 per cent. A total of 2,469 cubic feet of grit was removed.

SLUDGE DIGESTION AND DISPOSAL

At the south ward plant a total of 4.924 million gallons of raw sludge with an average total solids concentration of 4.2 per cent was pumped to the digesters. A total of 2,981 cubic yards of digested sludge was hauled from the digesters in 1973. The average total solids concentration was 12.8 per cent. The volatile solids was reduced from 68 to 41 per cent.

A total of 5.445 million gallons of raw sludge with an average total solids concentration of 5.7 per cent was pumped to the digesters at the north plant. A total of 8,799 cubic yards of sludge was hauled from the plant. The average total solids concentration was 10.0 per cent. The volatile solids increased 7 per cent from 64 to 71 per cent.

CONCLUSIONS

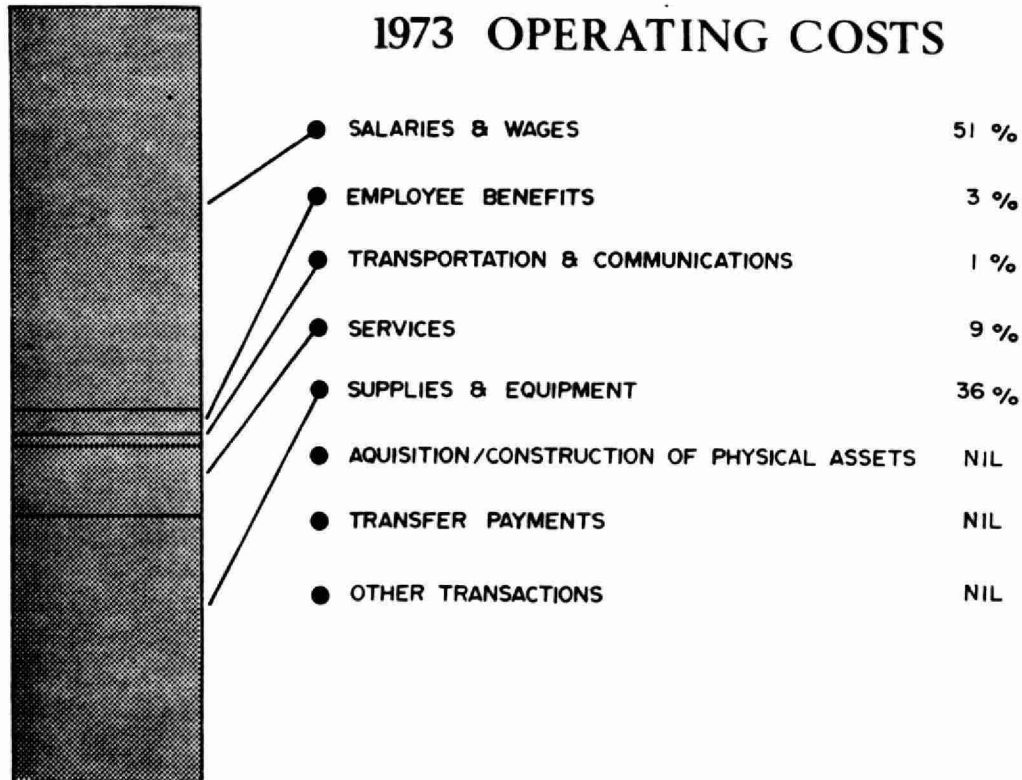
The flows exceeded the design capacity 100 per cent of the time at the north ward plant and 68 per cent of the time at the south ward plant. With the increase in the flows over 1972, the reductions of BOD and suspended solids decreased at both plants.

In addition, inefficient treatment of the sludge was noted. This is attributed to the increasing over-load conditions of this digester. The effectiveness of digestion at the south ward plant was satisfactory.

Plans to expand the sewage treatment capacity to 24 million gallons per day were well under way with construction (preloading) forecasted to begin in 1974. It is proposed to abandon the north ward plant and centralize the expanded treatment process at the south ward site.

ANNUAL COSTS

1973 OPERATING COSTS

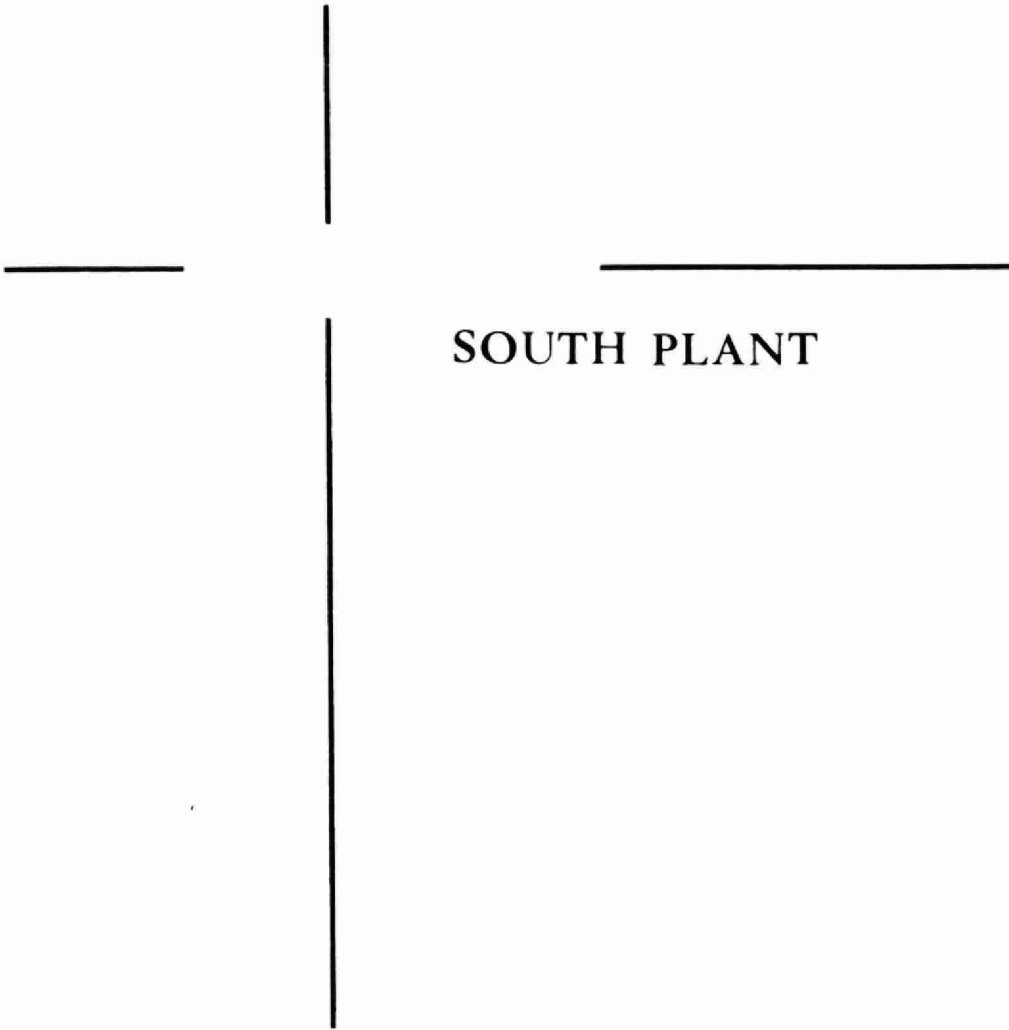


YEARLY OPERATING COSTS

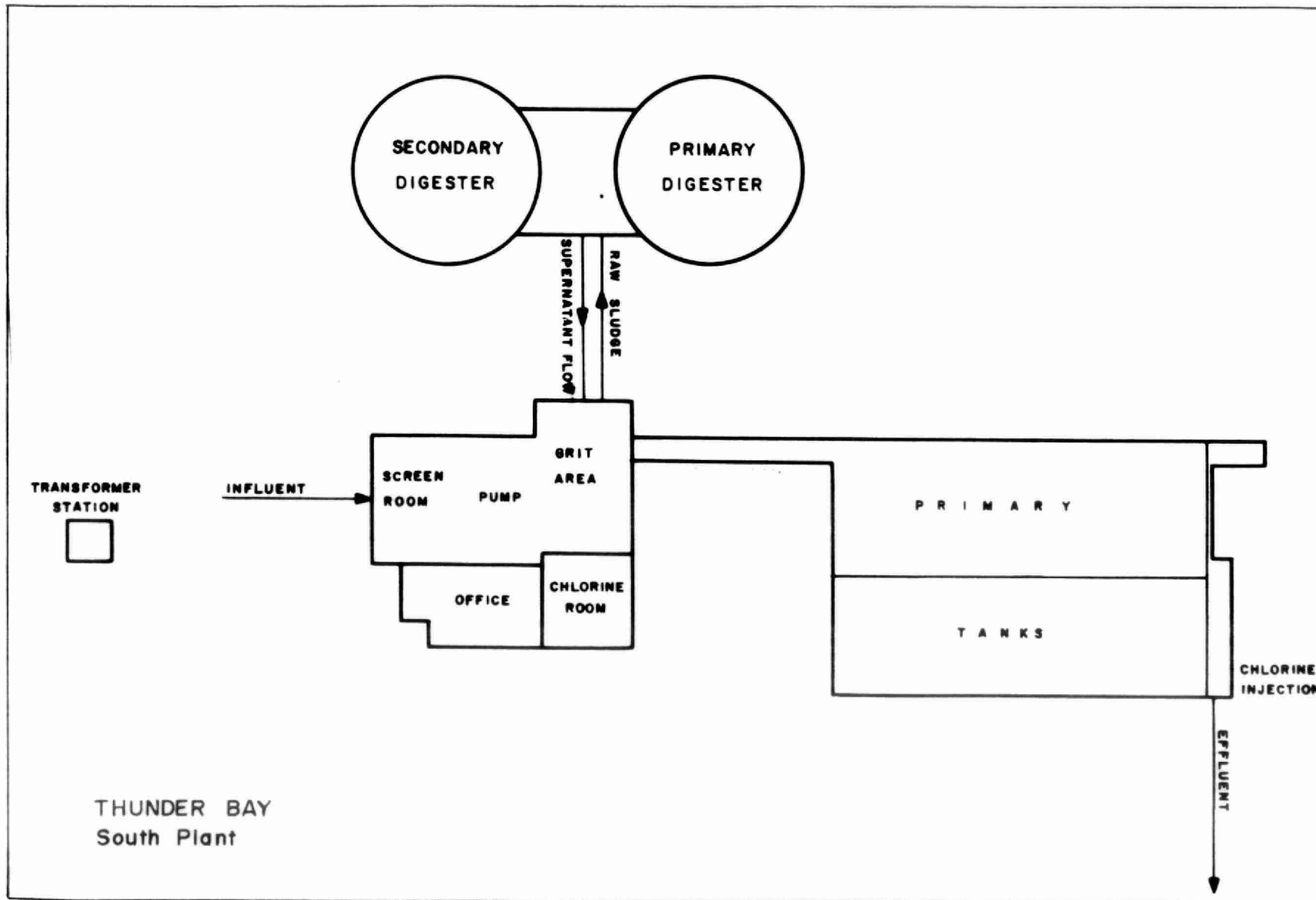
YEAR	SEWAGE TREATED in million gallons	TOTAL OPERATING COSTS	UNIT COSTS	
			\$/M.G.	¢/lb BOD
1968	4047	\$ 143,187	35	8
1969	3516	146,959	42	6
1970	4086	203,948	50	8
1971	4356	192,018	42	7
1972	4146	193,910	93	7
1973	4511	196,855	44	16

OPERATING EXPENDITURES

SALARIES AND WAGES	<u>\$101,275</u>
EMPLOYEE BENEFITS	<u>5,768</u>
TRANSPORTATION & COMMUNICATIONS	<u>2,037</u>
SERVICES	<u>17,003</u>
SUPPLIES AND EQUIPMENT	<u>70,772</u>
ACQUISITION/CONSTRUCTION OF PHYSICAL ASSETS	<u>0</u>
TRANSFER PAYMENTS	<u>0</u>
OTHER TRANSACTIONS	<u>0</u>
TOTAL	<u>\$196,855</u>



SOUTH PLANT



DESIGN DATA

PROJECT Thunder Bay S. WPCP

PROJECT NO. 2-0091-61

TREATMENT Primary

DESIGN FLOW 6.0 mgd

DESIGN POPULATION 48,000

PRIMARY TREATMENT

Screening

- Trash Racks
Type: Jeffrey
Size: Two with 3" spacing
- Grinder
Type: Jeffrey (One)
- Coarse bar screens
Type: David Brown
Size: Two with 1" spacing

Sewage Lift Pumps

Type: Fairbanks-Morse
Size: Two 5140 gpm @ $36\frac{1}{2}'$ tdh
Two 3490 gpm @ $36\frac{1}{2}'$ tdh
(variable speed, electric)

Grit Removal

Type: Aerated; grit removed by
clamshell bucket
Size: One 29' x 25' x 15' deep
Retention: 1.5 min

Primary Sedimentation

Type: Jeffrey
Size: Two 132' x 37' x 10' avg
(622,000 gal)

Retention: 2.5 hours
Loading: Surface, 600 gal/ft²/day
Weir, 10,000 gal/ft/day

CHLORINATION

W & T

Chlorine Contact Chamber

- in effluent chamber

OUTFALL

- to Kam River

SLUDGE HANDLING

Digestion System

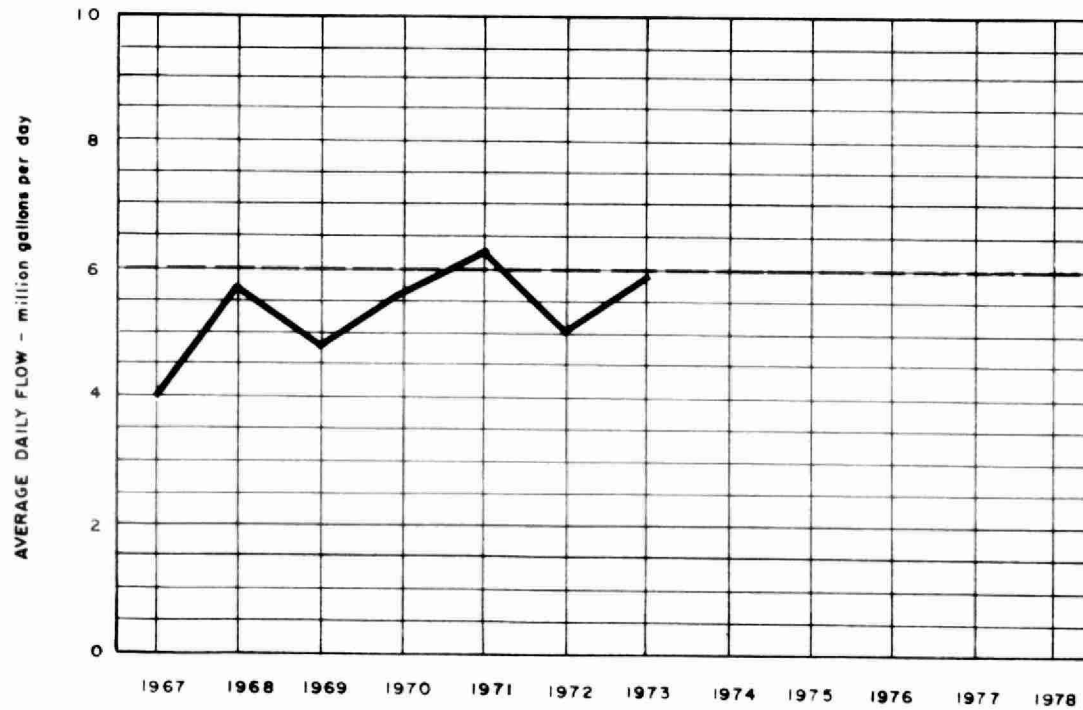
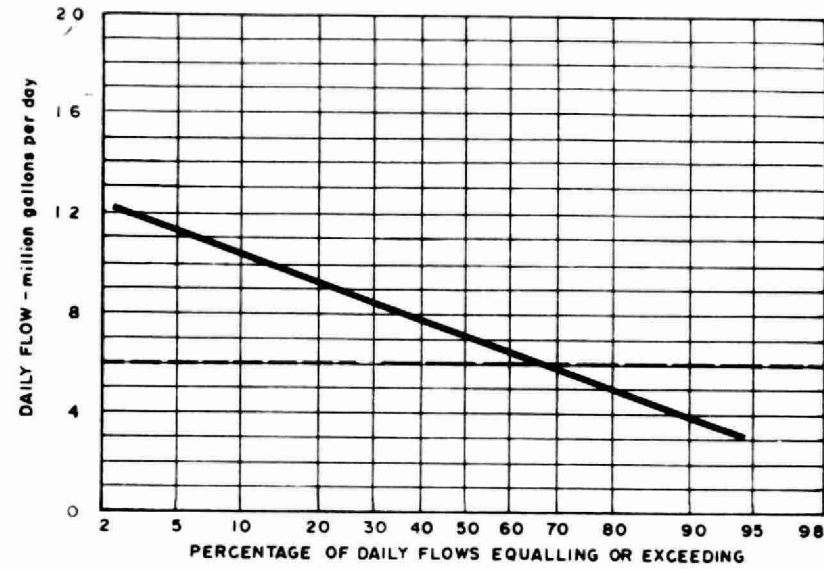
Type: Two-stage

Primary --
Type - Gas mixed PFT
Size - One 60' dia (71,000 cu ft or
442,000 gal)
Loading - 3.0 lb/ft³/mo

Secondary --
Size - One 60' dia (71,000 cu ft or
442,000 gal)
Total Loading - 1.5 lb/ft³/mo

PROCESS DATA

FLOWS

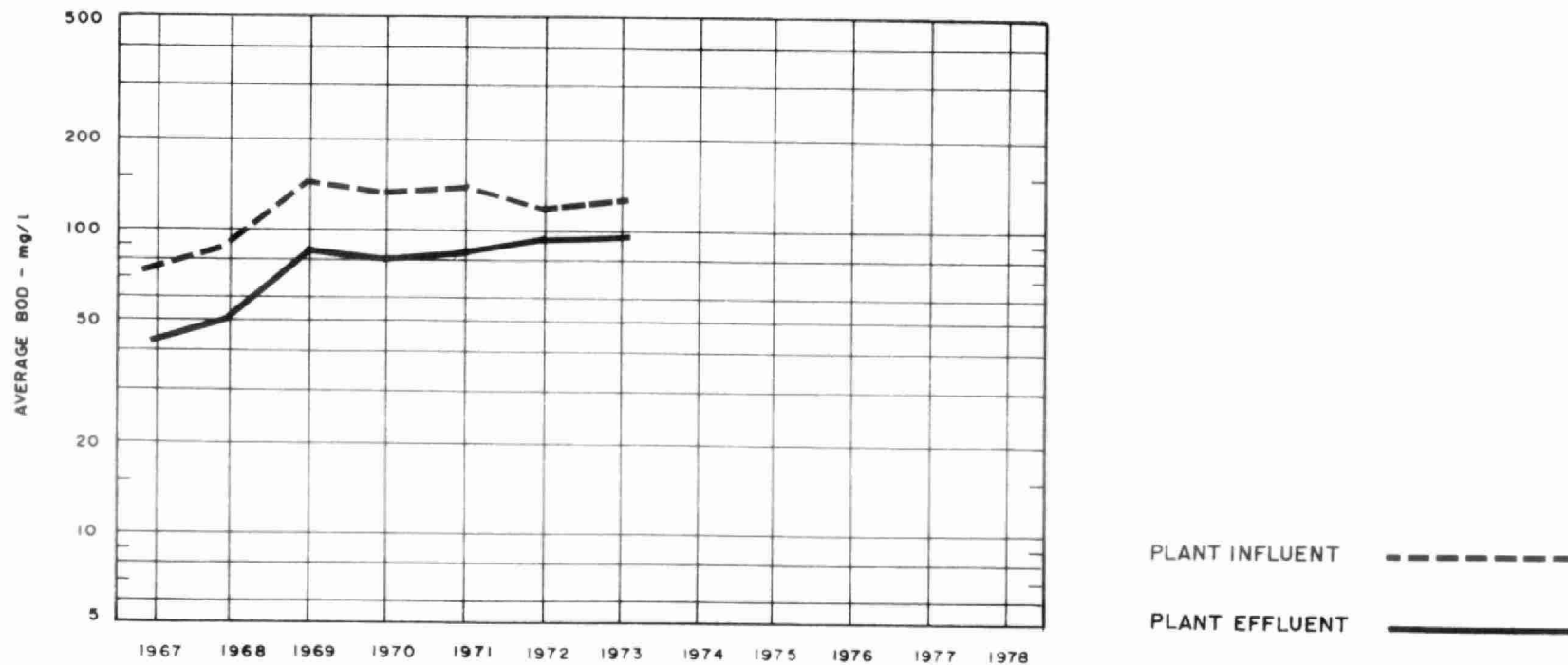
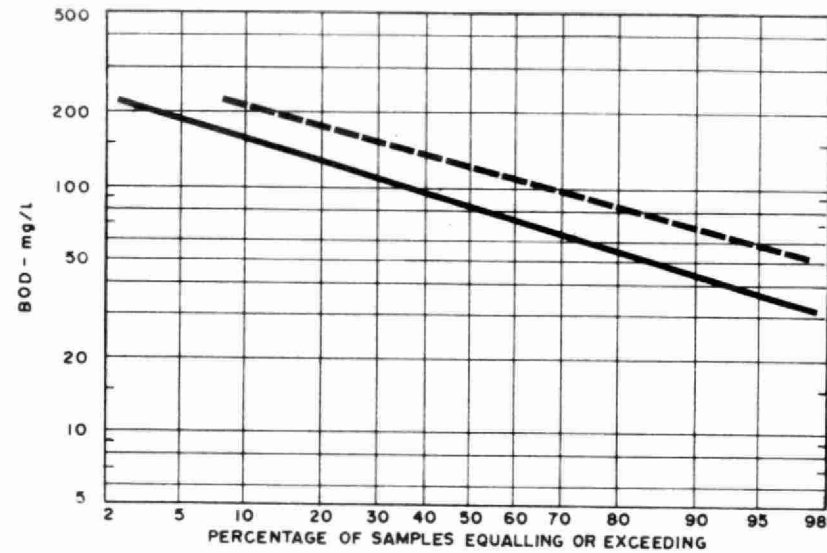


DESIGN CAPACITY — — — — —

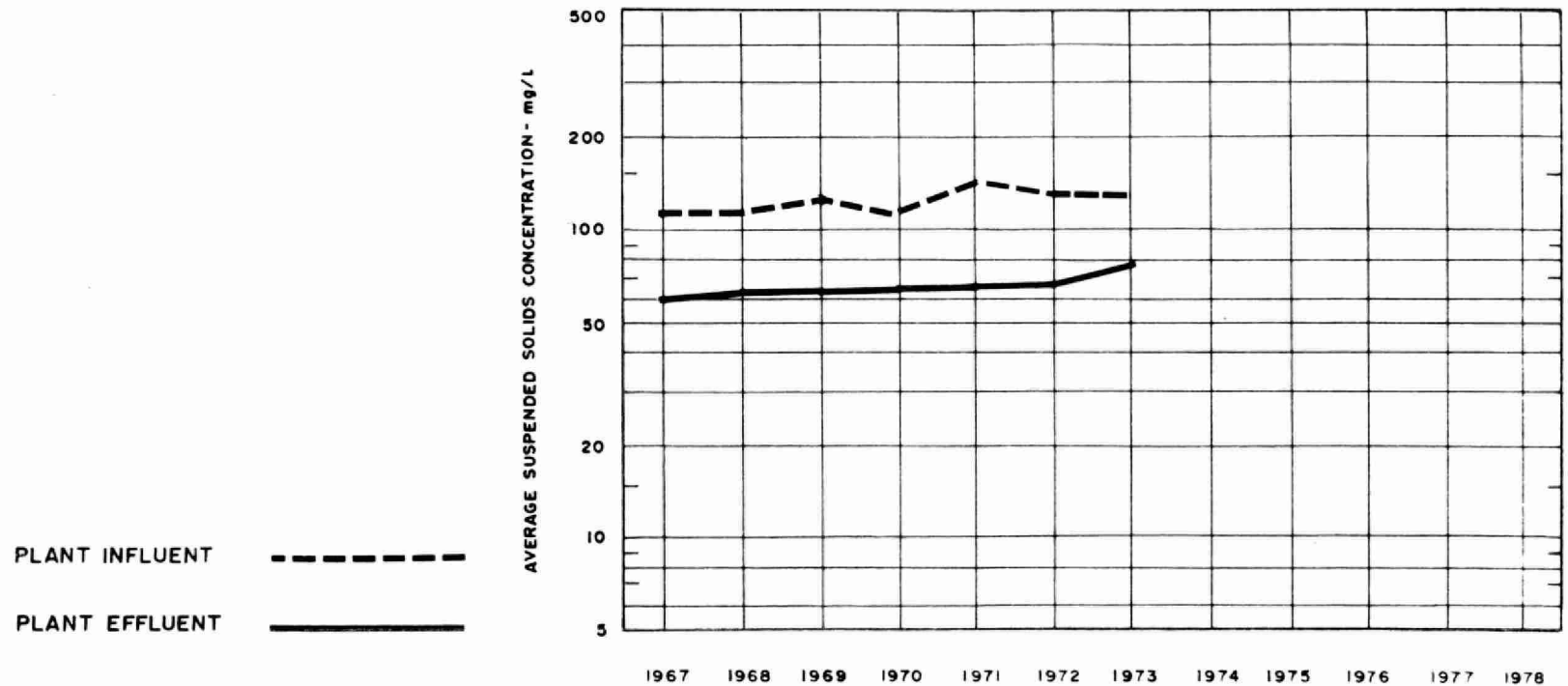
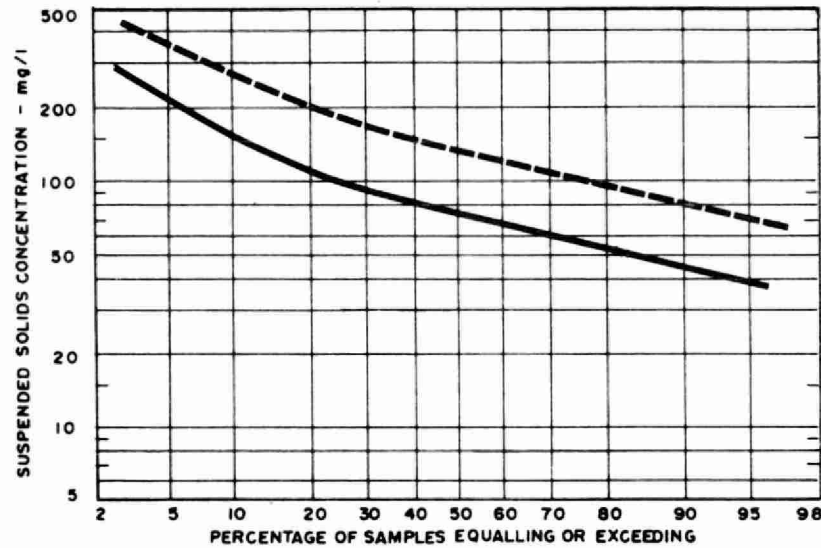
PLANT PERFORMANCE

MONTH	FLOWS			BIOCHEMICAL OXYGEN DEMAND				SUSPENDED SOLIDS				PHOSPHORUS	
	TOTAL FLOW	AVERAGE DAY	MAXIMUM DAY	INFLUENT	EFFLUENT	REDUCTION		INFLUENT	EFFLUENT	REDUCTION		INFLUENT	EFFLUENT
	million gallons	mil. gal	mgd	mg/l	mg/l	%	10 ³ pounds	mg/l	mg/l	%	10 ³ pounds	mg/l P	mg/l P
JAN	112.8	3.64	4.3	150	110	25	42.8	100	50	52	62.0	6.0	6.2
FEB	95.2	3.40	3.6	190	140	25	44.8	89	51	43	36.2	7.0	5.3
MAR	182.5	5.89	12.9	130	110	14	34.7	290	210	27	146.0	3.4	2.7
APR	156.4	5.05	7.5	130	100	22	46.9	120	77	34	61.0	6.9	6.1
MAY	179.3	5.78	9.8	110	73	34	66.3	110	67	40	78.9	3.3	2.0
JUNE	217.7	7.26	17.2	100	77	25	56.6	120	61	48	121.9	3.9	2.7
JULY	206.5	6.66	13.8	94	67	29	55.7	130	81	38	101.1	6.3	3.3
AUG	232.6	7.50	17.8	73	63	13	23.3	130	64	49	144.2	3.2	2.8
SEPT	231.3	7.71	13.3	170	100	42	166.5	120	70	43	120.3	1.6	1.6
OCT	191.6	6.18	10.4	140	120	15	40.2	99	51	48	92.0	3.1	2.3
NOV	197.8	6.59	16.8	95	81	15	27.7	130	87	33	83.1	5.3	2.6
DEC	159.0	5.13	6.7	120	92	26	52.5	120	77	36	68.4	4.2	3.2
TOTAL	2162.7	-	-	-	-	-	658.0	-	-	-	1115.1	-	-
AVG.		5.92	MAXIMUM 17.8	120	96	23	54.8	130	78	39	92.9	4.5	3.4
No. of Samples	-	-	-	60	61	-	-	60	60	-	-	12	12

BIOCHEMICAL OXYGEN DEMAND

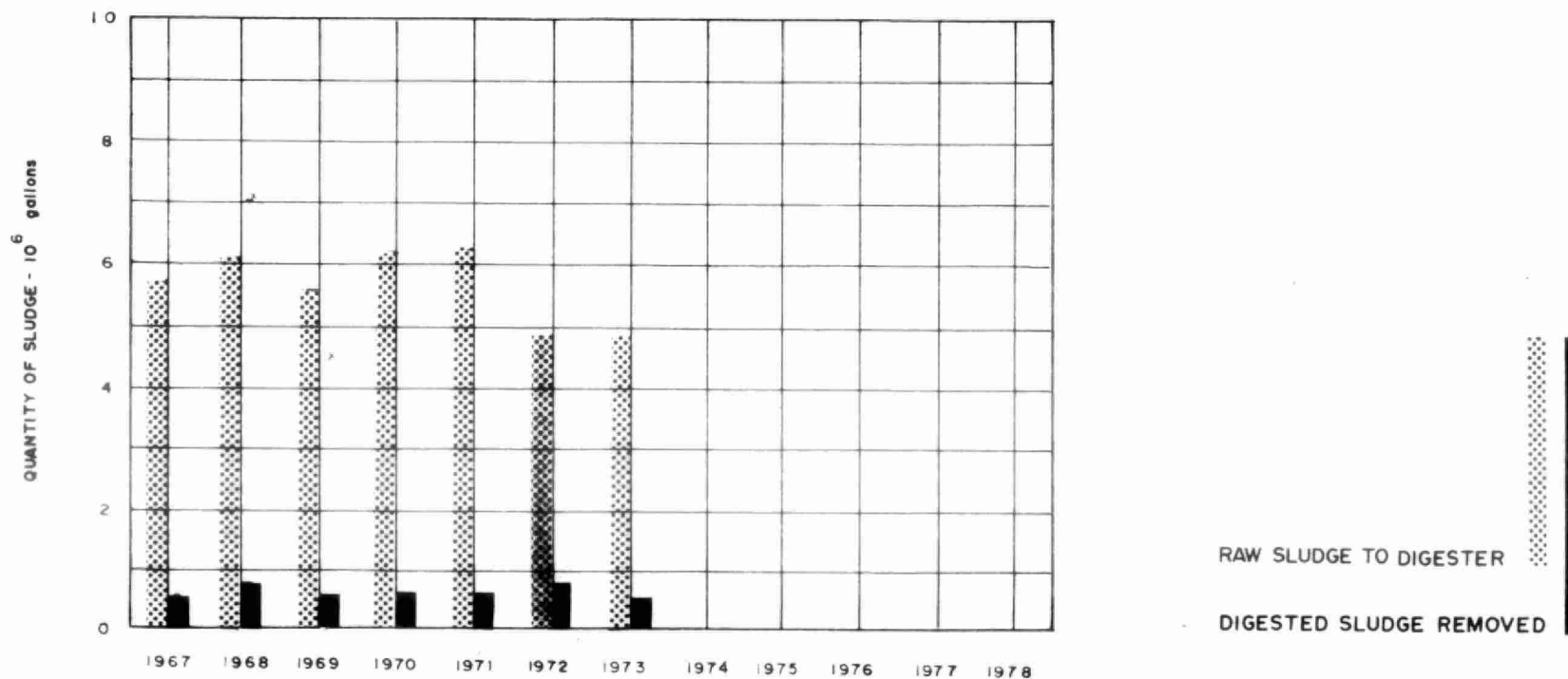
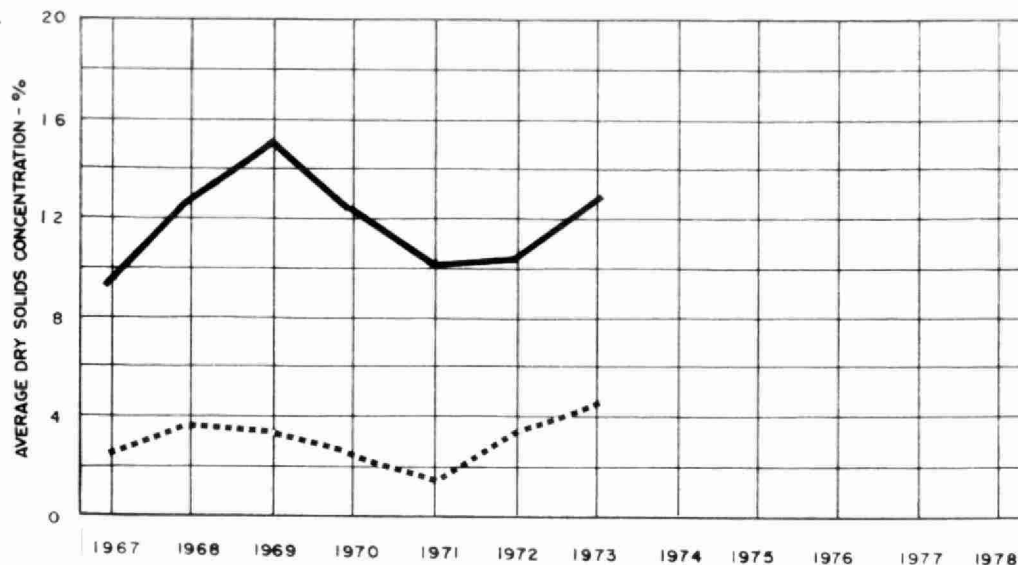


SUSPENDED SOLIDS

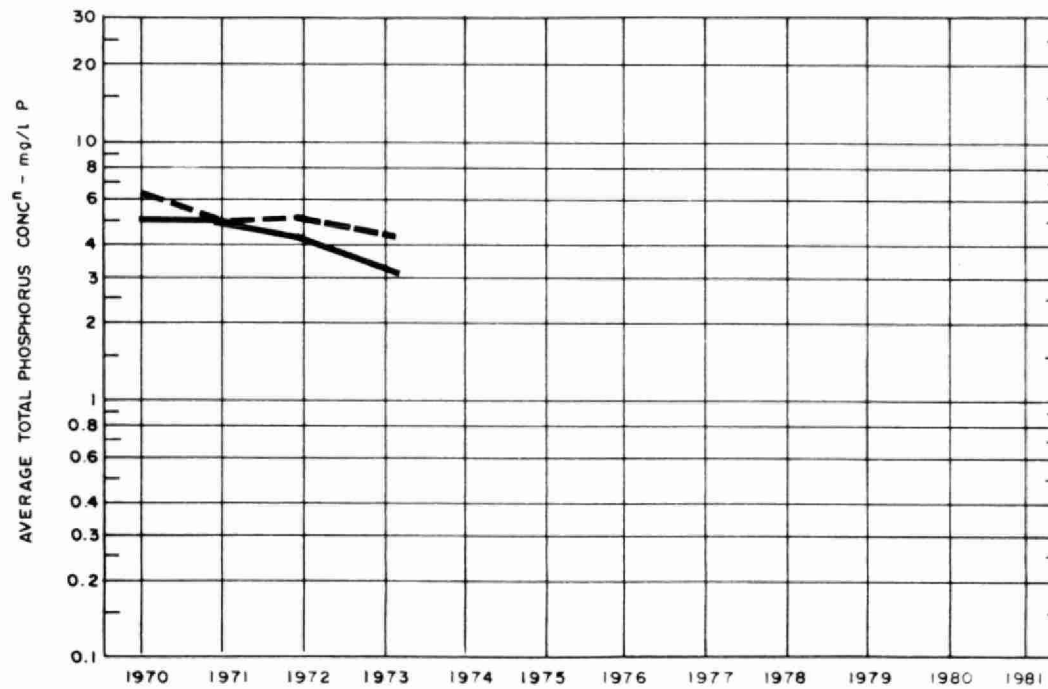
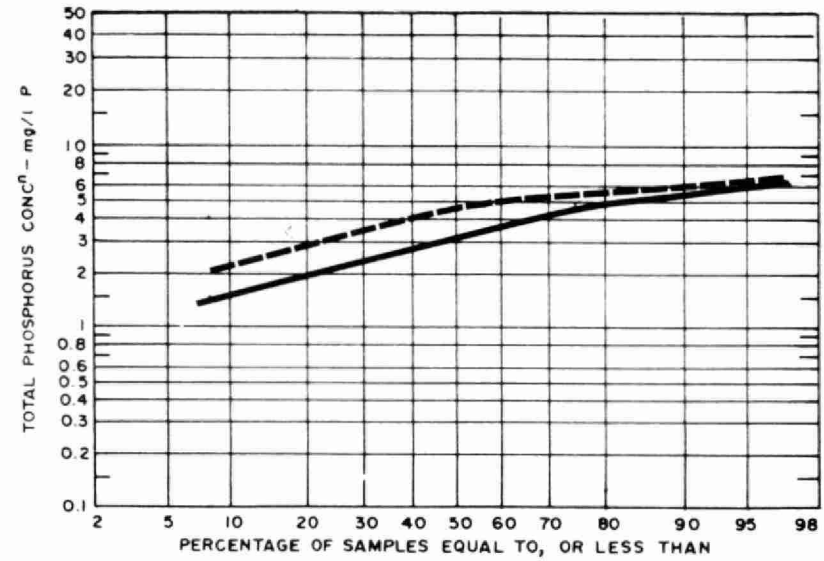


DIGESTION

RAW SLUDGE
DIGESTED SLUDGE ———



PHOSPHORUS

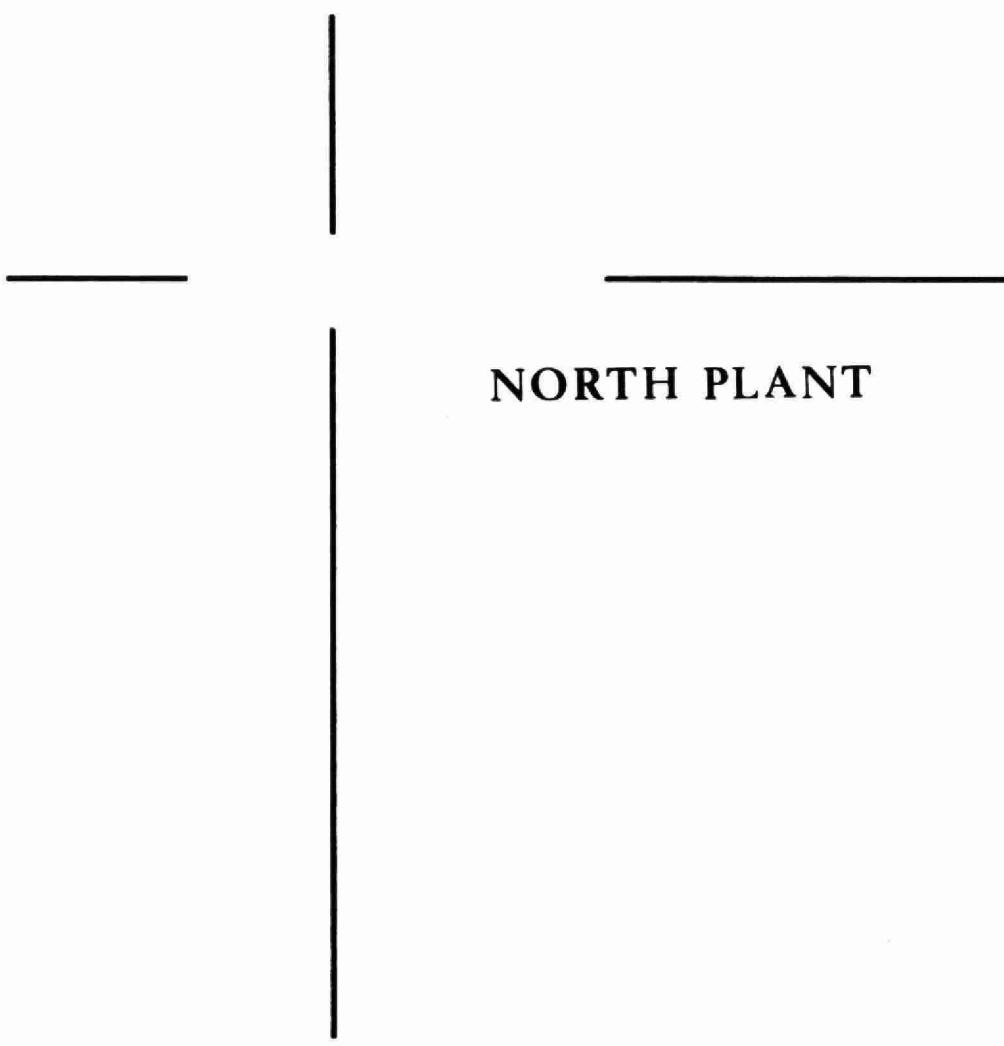


PLANT INFLUENT - - - - -

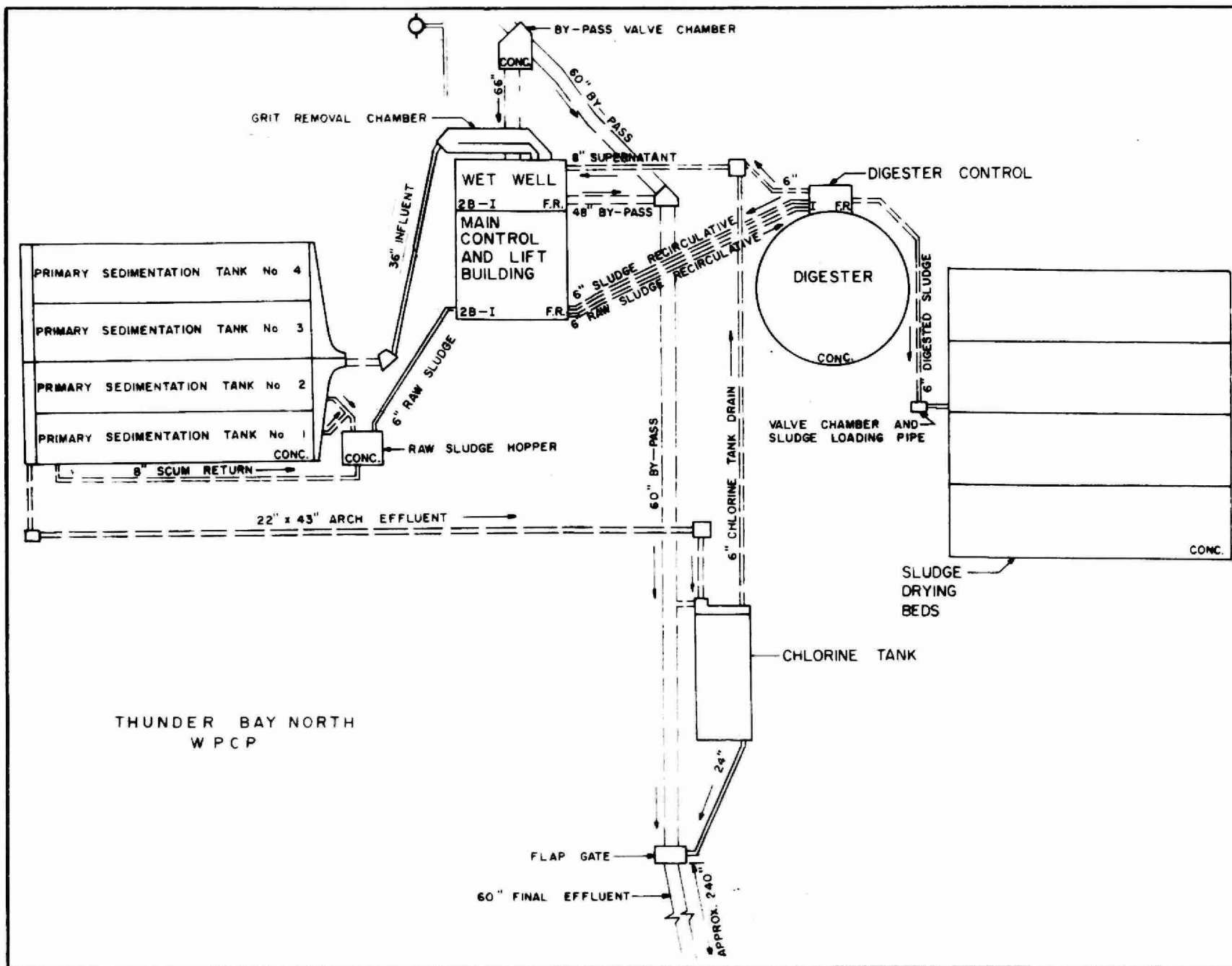
PLANT EFFLUENT —————

TREATMENT DATA

	GRIT	CHLORINATION		SLUDGE DIGESTION and DISPOSAL							
MONTH	QUANTITY REMOVED cubic feet	CHLORINE USED 10 ³ pounds	AVERAGE DOSAGE mg/l	RAW SLUDGE			DIGESTED SLUDGE			SUPERNATANT	SLUDGE HAULED cubic yards
				QUANTITY 10 ³ gallons	TOTAL SOLIDS %	VOLATILE SOLIDS %	QUANTITY REMOVED 10 ³ gallons	TOTAL SOLIDS %	VOLATILE SOLIDS %	TOTAL SOLIDS %	
JAN	395	6.4	5.7	302	2.3	80	7	14.0	30		44
FEB	323	5.9	6.2	238			109				649
MAR	1033	6.9	3.8	634	4.7	60		11.1	41		
APR	772	6.6	4.2	430	2.9	74		9.0	95		
MAY	620	5.6	3.9	442	3.9	74	102	11.0	36		605
JUNE	885	6.8	3.1	446	3.1	55		18.5	27		
JULY	309	7.2	3.5	424	8.5	73	122	11.8	38		726
AUG	473	7.1	3.0	445	5.5	45		10.0	41		
SEPT	280	7.0	3.0	457							
OCT	665	6.9	3.6	409	4.8	73	15	8.6	48	0.6	88
NOV	643	6.9	3.5	399	2.3	72	87	17.2	27		517
DEC	700	6.6	4.2	298	4.0	72	59	17.0	25	0.2	352
TOTAL	7098	79.9	—	4924	—	—	501	—	—	—	2981
AVG.	3.3 cubic feet/mil gal	6.6	3.7	410	4.2	68	41.8	12.8	41	0.4	2486



NORTH PLANT



DESIGN DATA

PROJECT Thunder Bay N. WPCP

PROJECT NO. 2-0013-58

TREATMENT Primary

DESIGN FLOW 4.0 mgd

DESIGN POPULATION 40,000

Grit Removal

Type: Channels; mechanically cleaned
(Rex San.)
Size: Two 35' x 3' x 5' deep (6,540 gal)
Retention: 4.7 min (two channels)
Flow Velocity: 0.248 fps

Comminution

Type: Barminutor
Size: One Model B (35")
One Model A1 (48")

Sewage Lift Pumps

- a) Type: Chicago Pumps (ele)
Size: Two 4150 gpm @ 50' tdh
- b) Type: Fairbanks-Morse (diesel)
Size: One 29,000 gpm @ 33' tdh

Primary Sedimentation

Type: Jeffrey
Size: Four 100' x 18' x 8' deep
(356,000 gal)
Retention: 2.14 hr

Loading: Surface, 560 gal/ft²/day
Weir, 6,000 gal/ft/day

CHLORINATION

Type: W & T
Size: One 500 lb/day

Chlorine Contact Chamber

Size" 45' x 20' x 10'
Retention: 20 min

OUTFALL

- 240' of 60" dia corrugated pipe to McIntyre River

SLUDGE HANDLING

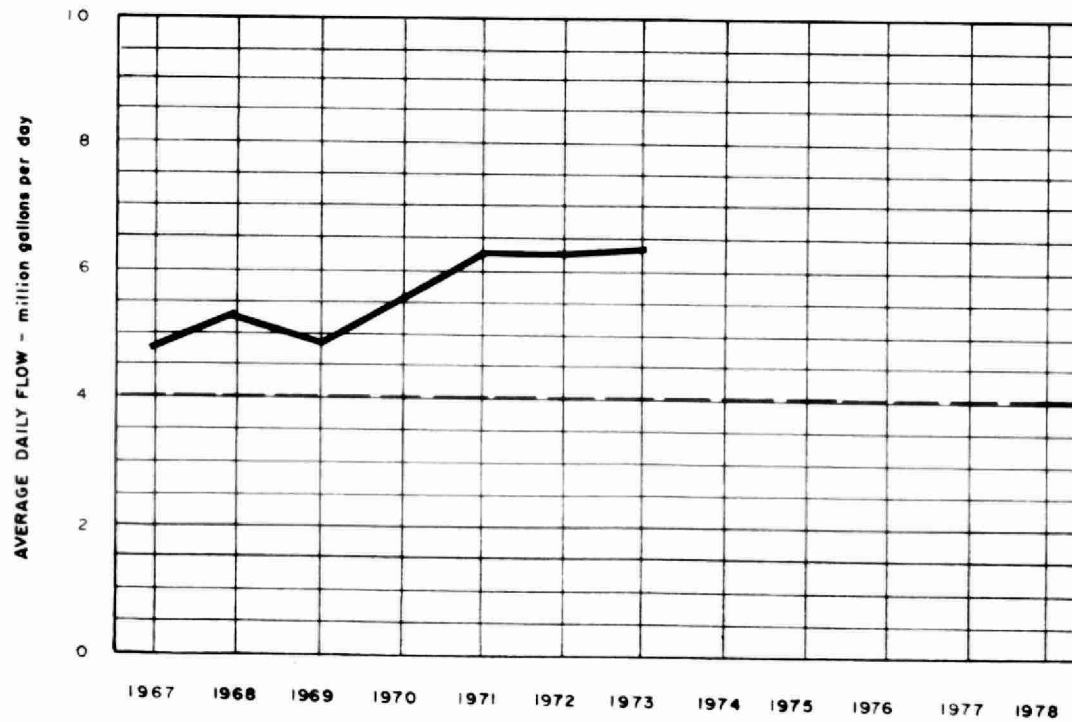
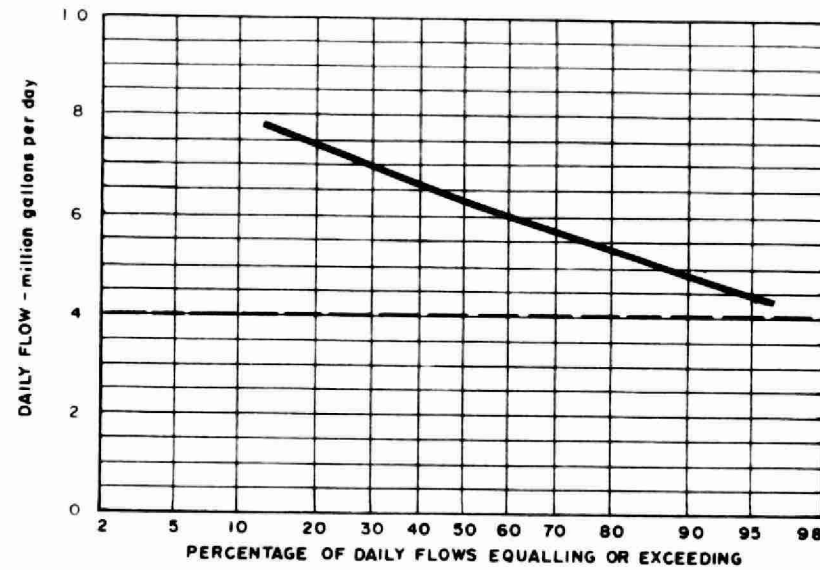
Digestion System - Single-stage

Type: Mixed by recirculation; floating
cover
Size: One 50' dia x 20' swd (50,000 cu ft
or 0.312 mil gal)
Loading: 2.0 lb/cu ft/mo

Drying Beds

Size: Four 100' x 25' (10,000 sq ft)

PROCESS DATA FLOWS

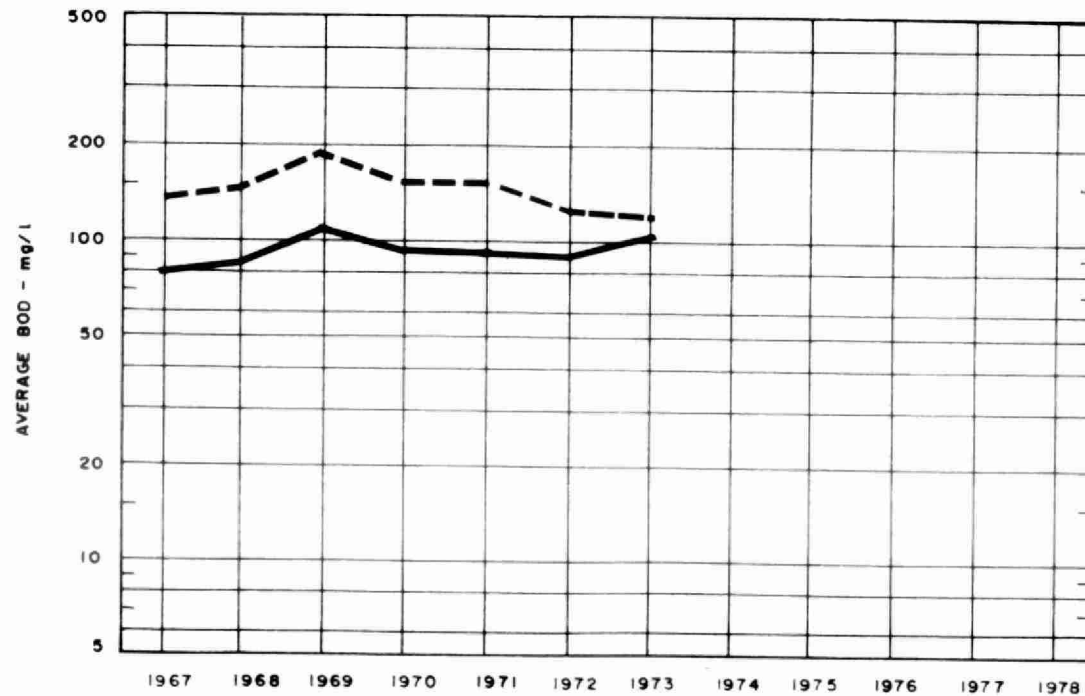
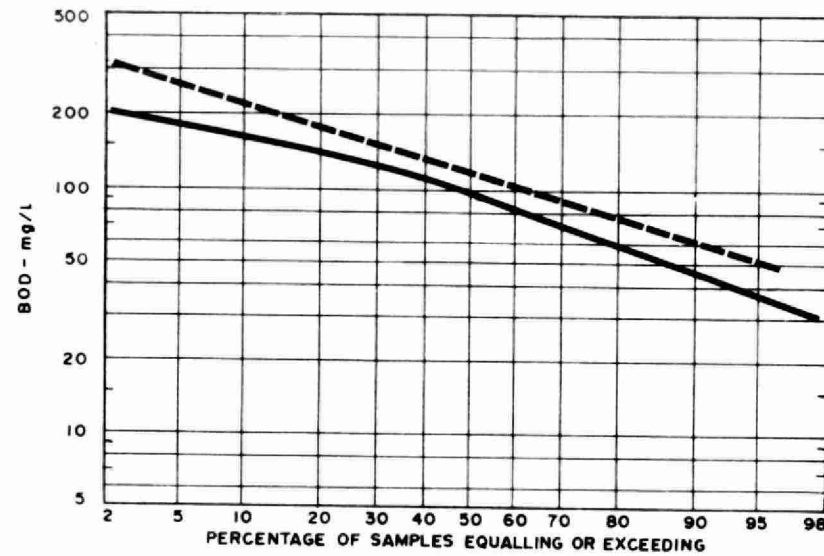


DESIGN CAPACITY - - - - -

PLANT PERFORMANCE

MONTH	FLOWS			BIOCHEMICAL OXYGEN DEMAND				SUSPENDED SOLIDS				PHOSPHORUS	
	TOTAL FLOW million gallons	AVERAGE DAY mil. gal	MAXIMUM DAY mgd	INFLUENT mg/l	EFFLUENT mg/l	REDUCTION		INFLUENT mg/l	EFFLUENT mg/l	REDUCTION		INFLUENT mg/l P	EFFLUENT mg/l P
						%	10 ³ pounds			%	10 ³ pounds		
JAN	159.3	5.14	5.8	140	140			120	89	29	57.3	7.5	7.5
FEB	144.1	5.15	5.4	230	160	31	102.3	150	71	54	119.6	6.4	5.2
MAR	207.9	6.71	7.9	150	100	30	93.6	310	136	56	363.9	5.3	2.7
APR	192.5	6.42	7.1	130	120	5	11.5	120	64	49	117.4	6.2	7.1
MAY	205.2	6.62	7.3	93	73	22	41.0	120	56	51	121.1	4.3	3.3
JUNE	195.9	6.53	7.5	100	76	25	49.0	120	77	35	80.3	4.3	3.5
JULY	178.9	5.77	7.8	91	66	27	44.7	140	85	37	89.5	5.7	4.5
AUG	220.0	7.10	7.9	89	67	25	48.4	110	64	43	114.4	5.0	3.1
SEPT	229.1	7.64	8.0	130	120	12	38.9	95	45	53	114.6	2.4	2.2
OCT	219.8	7.09	7.9	170	120	28	1.1	110	66	41	101.1	4.3	3.2
NOV	201.9	6.73	8.0	99	82	17	34.3	100	84	18	38.4	4.0	3.6
DEC	193.5	6.24	7.8	98	97	1	1.9	130	75	42	108.3	4.2	3.4
TOTAL	2348.1	-	-	-	-	-	466.7	-	-	-	1425.9	-	-
AVG.		6.43	MAXIMUM 8.0	130	100	19	38.9	140	76	44	118.8	5.0	4.1
No. of Samples	-	-	-	62	62	-	-	62	62	-	-	12	12

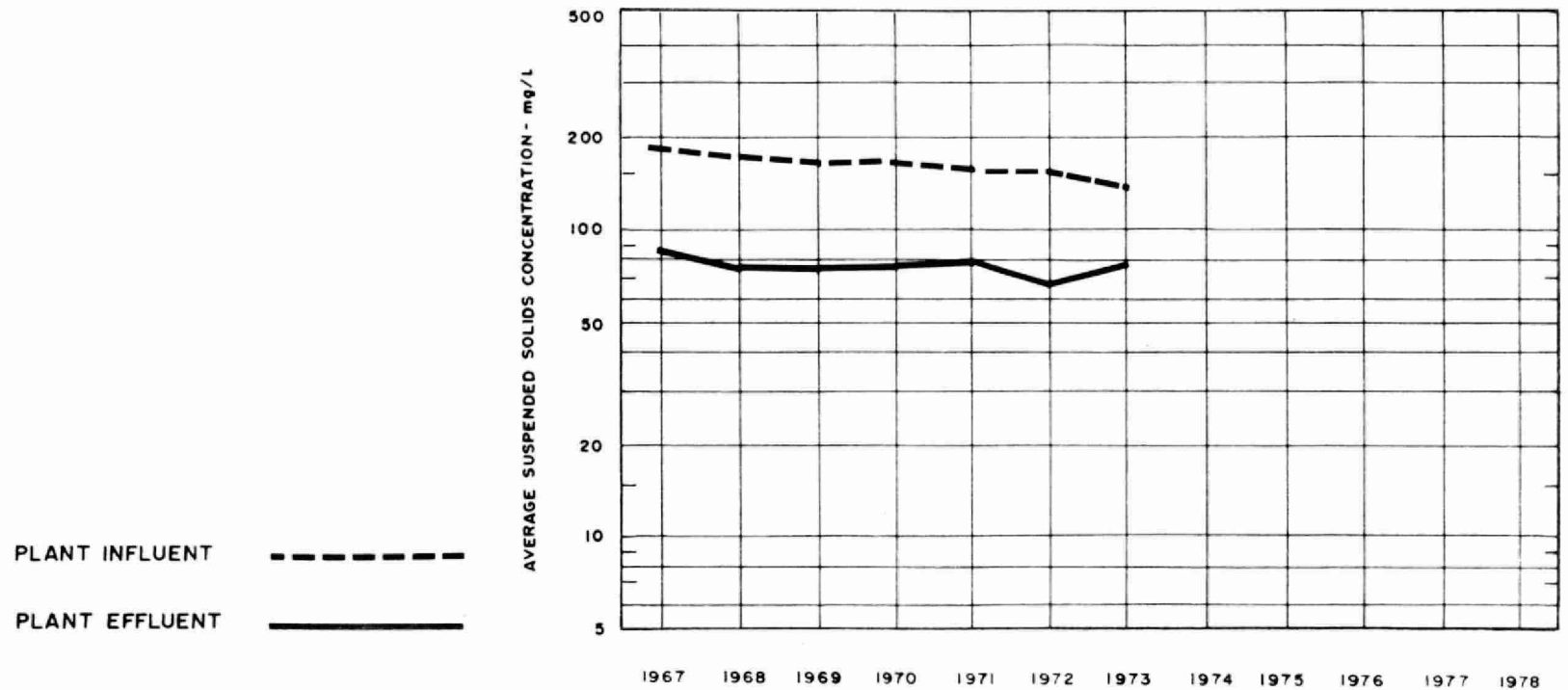
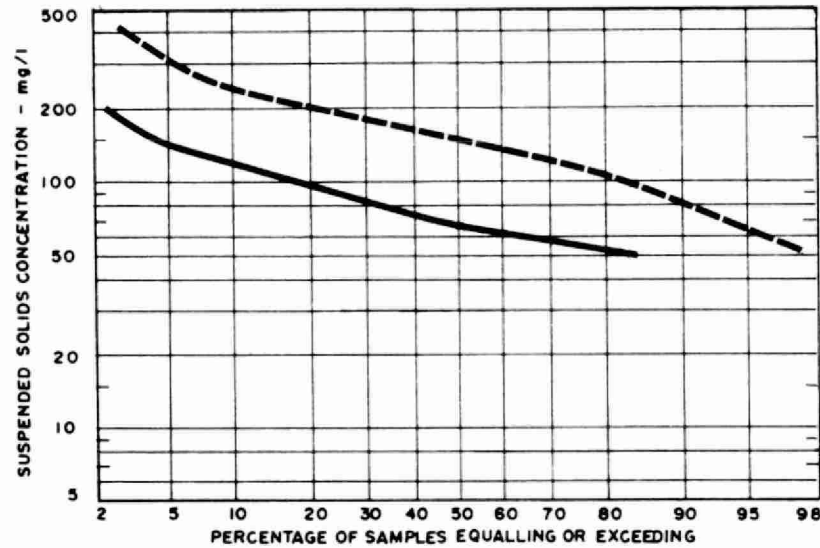
BIOCHEMICAL OXYGEN DEMAND



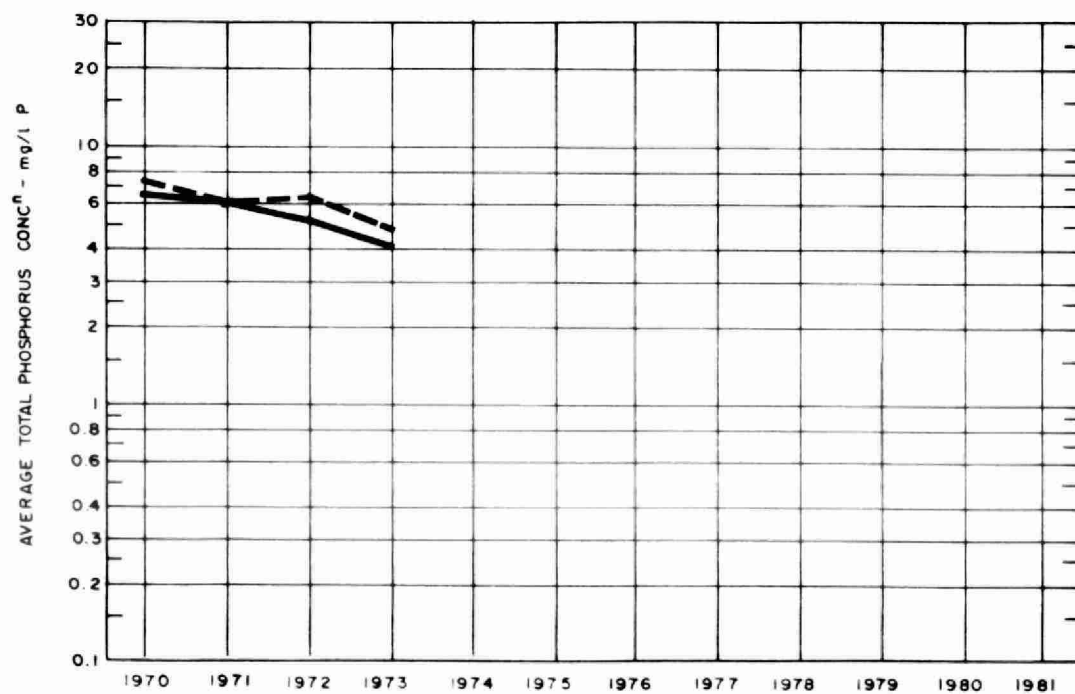
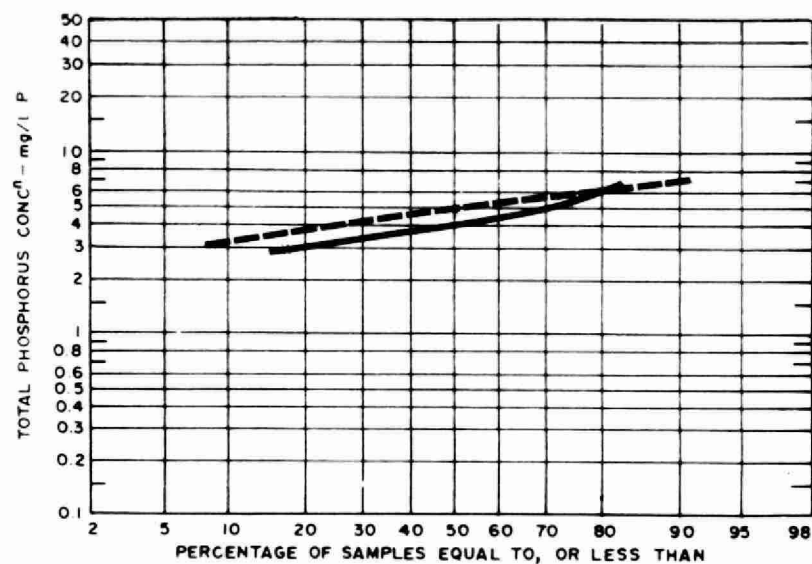
PLANT INFLUENT - - - - -

PLANT EFFLUENT _____

SUSPENDED SOLIDS



PHOSPHORUS

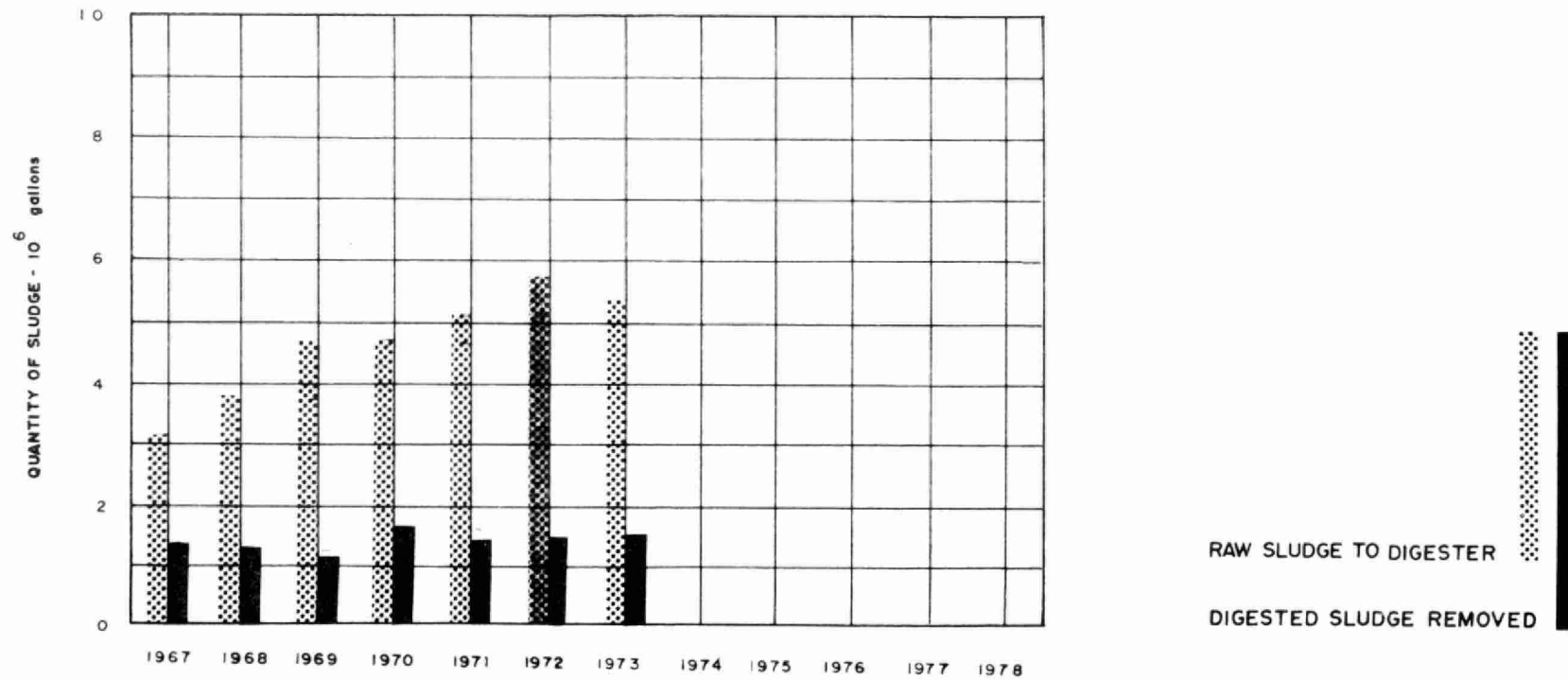
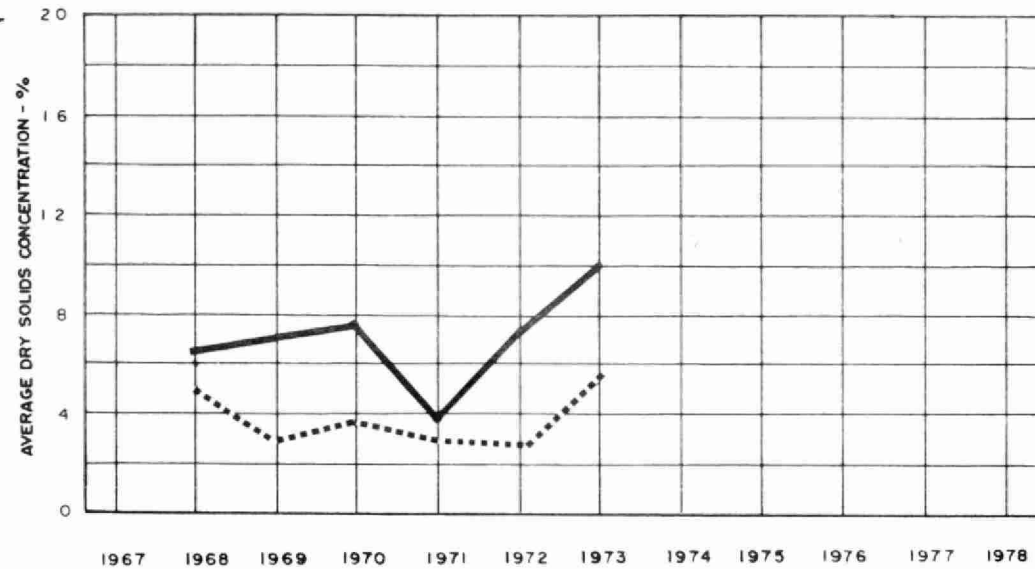


PLANT INFLUENT - - - - -

PLANT EFFLUENT —————

DIGESTION

RAW SLUDGE
DIGESTED SLUDGE ———



TREATMENT DATA

MONTH	GRIT	CHLORINATION		SLUDGE DIGESTION and DISPOSAL							
	QUANTITY REMOVED cubic feet	CHLORINE USED 10 ³ pounds	AVERAGE DOSAGE mg/L	RAW SLUDGE			DIGESTED SLUDGE			SUPERNATANT	SLUDGE HAULED cubic yards
				QUANTITY 10 ³ gallons	TOTAL SOLIDS %	VOLATILE SOLIDS %	QUANTITY REMOVED 10 ³ gallons	TOTAL SOLIDS %	VOLATILE SOLIDS %	TOTAL SOLIDS %	
JAN	49	0		551	3.6	83	306	7.8	77		1816
FEB	161	0		487			15				88
MAR	634	0.8	3.0	535	4.4	62	11	10.8	62		66
APR	134	7.8	4.1	526	3.2	82	276	9.4	68		1639
MAY	47	7.8	3.8	459	3.1	83	91	6.5	70		539
JUNE	149	8.0	4.1	393	3.3	73	93	9.3	74		550
JULY	112	7.8	4.3	408	3.5	78	68	11.1	74		407
AUG	483	8.0	3.6	415	5.4	70	408	7.8	68		2420
SEPT	133	7.8	3.4	401			43				253
OCT	107	5.2	3.3	440	25.2	74	0	10.5	68	0.6	0
NOV	339	0		415	3.3	79	128	9.1	75		759
DEC	121	0		415	2.5	83	41	10.2	77	1.4	242
TOTAL	2469	53.2	—	5445	—	—	1480	—	—	—	8779
AVG.	1.0 cubic feet/mil gal	6.6	4.1	454	5.7	64	123	10.0	71	1.0	7981

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